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ABSTRACT

This report describes a project in Malaysia which provided three pilot courses using computer-assisted instruction (CAI) for both inservice and preservice teachers. Two courses for secondary teachers introduced the use of CAI in the secondary classroom and Logo for secondary mathematics, and primary teachers were given an introduction to the use of CAI with their students. The numerous factors that influenced the outcomes of this project are discussed, including problems with administration, transportation, "red tape," facilities, equipment repair, language of instruction, staff development, and time allotments. However, it was also found that: (1) inexpensive microcomputers can be reliable; (2) the teachers who participated in the course came away with more optimistic attitudes toward computer use in education; (3) the majority of teachers learned to program and could produce CAI and Logo programs in the Malaysian language; and (4) the only background differences that significantly affected the final examination scores were English listening skills. A discussion of the possible implications of the study for educational planners in developing nations concludes this report. A 68-item reference list is appended. (EW)

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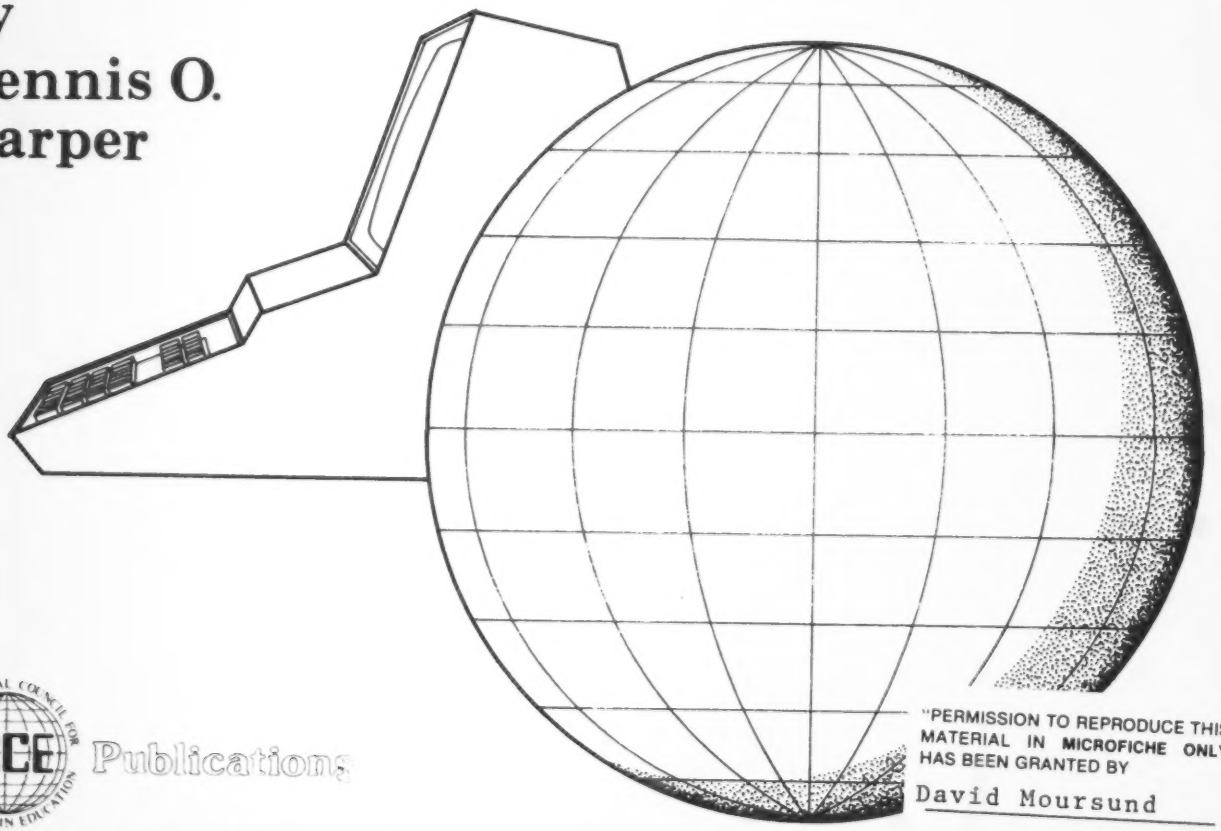

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PREFACE

This book describes a project designed to provide an innovative computer-based learning environment for both primary and secondary school teachers in Malaysia. A key purpose of the project was to determine the conditions that influence successful use of microcomputers for both inservice and preservice education in a developing nation setting, thus improving educators' estimates of what conditions are necessary for using such technology in Malaysia and other developing countries. It was not the purpose of this study to train teachers so they would be able to use computers in their classrooms; most teachers would require substantially more than a ten-week course to even begin to help their students realize the potential of the computer.

An Educational Computer Laboratory was established at the Department of Education at the University Kebangsaan Malaysia (Malaysian National University). The laboratory contained ten Atari 800 microcomputers complete with disk drives, printers, color monitors and additional peripherals and software. The project took place from June to November, 1983.

This document contains four chapters:

1. **Introduction** - The opening chapter presents the history of computers in developing nation classrooms and suggests the potential importance, need and timeliness of computer use for the education of teachers and students in developing societies. The chapter also includes a list of educational problems shared by many developing nations and proposes that computers have the potential to partially alleviate these problems. The chapter further describes the social relevance of the educational problems and their relation to the needs in society. Finally, a review is made of previous research work on these problems, with results and limitations.

2. **Background** - The second chapter first reviews the specific research questions on which the present study focused, then explains events leading to the commencement of the project. Next, the research design is outlined. Subsequently, the classes taught with the aid of the computer are described as well as follow-up activities.

3. **Conditions For Success** - Chapter 3 describes numerous factors that influenced the outcomes of this project in using computers to train teachers in Malaysia. These considerations included problems with administration, transportation, "red tape", facilities, equipment repair, language of instruction, staff development, and time allotments. Implications that the Malaysian project offered for managing such factors in other developing societies are also suggested.

4. **Conclusions and Recommendations** - The book concludes with the implications of the project for research, theory, methodology, substantive knowledge, and the use of this knowledge by the people who may profit from it.

CHAPTER ONE

INTRODUCTION

Only since the advent and refinement of the microcomputer in the past five years has it been considered possible to use computers to teach large groups of students. This possibility, however, has generally been examined only in a few highly-developed Western nations where the cost of training vast numbers of teachers and of purchasing sufficient microcomputers is a practical possibility. Using computers to teach large numbers of students in a developing nation does not at this time seem feasible because of such problems as widespread populations, limited funds, technical limitations (including lack of electricity), minimal basic literacy, and shortages of teachers. While there have been isolated projects in the developing nations that have attempted to use computers for teacher upgrading, there seems to have been little coordination among these projects by any international body.

WCCE

Of the efforts that have been made to support international computer education, perhaps the largest has been the World Conference on Computers in Education (WCCE), co-sponsored by UNESCO and IFIP (International Federation of Information Processing).

Approximately twice each decade this conference is held on an international scale. The third conference was held in Lausanne, Switzerland, during the week of July 26, 1981. The next World Conference will be held July 29 - August 2, 1985 in Norfolk, Virginia, U.S.A. The Lausanne conference attracted 1266 participants from 67 nations. As a participant in the conference, I was afforded the opportunity to attend seminars and talk to many people who were involved with computer education in developing nations.

The conference was divided into the following six strands:

1. Information and various disciplines

2. Computer-assisted learning (CAL) and other direct uses of computers in education

3. The impact of new technologies

4. Social impact, including the changing role of teachers

5. National policies and models for computer education with special reference to the needs of developing countries

6. Aims, policies and curricula for information science education

Prerequisites for CAL in Developing Nations

The sessions I attended dealt mainly with precollege populations and teacher training. The proceedings of the conference (Lewis & Tagg, 1981) contain all papers which were delivered. Numerous sessions focused on what developing countries perceive as prerequisites for the introduction of computers and compu-

ter-assisted learning (CAL). [1]

The major prerequisites discussed were:

* **Teacher Education** -- Teacher training centers are needed to instruct educators about computers. (The Malaysian project described in the following chapters included an attempt to prepare a center for such instruction.) If the teachers are not convinced that computer education can benefit their students, it is doubtful that any effort in this area will succeed.

* **Higher Literacy Rates** -- The educational level of developing countries must be raised if the transfer of technology is to take place. (This seemed to be a concern for many participants, but the importance of this issue is questionable, as will be seen later in this book.)

* **Appropriate Hardware and Configurations** -- Computers must be able to provide services which respond to diverse needs. Inappropriate hardware purchases can be costly and counterproductive. One outcome of this study is to analyze the effectiveness of the low-cost microcomputers used for teacher training in Malaysia.

* **Coherent National Policies Regarding Computer Education** -- It seems quite clear that developing countries have many differences in their educational priorities, and these differences clearly have important implications for the emphasis placed on computer use in education. Countries must know why they are using computers. "Know-how" is useless unless you know why. The results of this study are intended to offer some help in developing national computer education policies.

* **Serious Consideration of the Computer's Possible Repercussions on Education and Culture** -- The computer's effect on privacy, unemployment, elitism, corruption and issues of equity are a few concerns that need to be addressed on an international level.

* **Very Good Knowledge of Technical English by Those Who Need to Fully Understand Computers.** -- Most computers and their associated documentation are produced in English-speaking countries. The influence that English skills have on programming ability is a major focus of this study.

* **International Cooperation** -- Developing countries cannot afford to reinvent the wheel. Additionally, developing countries can learn from the mistakes of the more developed nations. International cooperation is necessary in developing global communications systems aimed at the transfer of knowledge (education).

* **Necessary Courseware and Curricula** -- Such courseware is most suitably developed within the country or region. More practical courses are needed. Countries should identify the common skills and materials to be taught with the aid of the computer.

* **Research Centers** -- These are needed to help determine educational directions and policies. The present study could be used as an example

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[1] See papers by Gulati, deWet & Calitz, Abass, Bouras, Zmud & Cotterman, and Rateau in the proceedings of Lewis & Tagg (1981).

of the research developing nations may wish to conduct.

(Many of these prerequisites that apply to the Malaysian study are discussed at length in Chapter 3.)

Key Questions Concerning CAL and Implications for the Present Project

Other areas that were discussed included educational strategies, UNESCO activities, reasons for past failures of computers in education, advantages and disadvantages of computer education, and current programs. Detailed discussion of these areas is not possible here, but a number of key questions that arose during the conference are worth mentioning because of their implications for both the present research project and as questions educational planners may wish to raise when considering actions based on this research.

The questions include:

* How can available funds best be spent? If a developing country has money available for computer education, should it be spent for research, teacher training, equipment, consultants, or sending personnel to developed countries to study computer-assisted learning?

* How does one get educators to keep up with the technology?

* Should the goal be to provide "computer training" (training people to use computers) or "computer education" (using computers to educate people)?

* How does one best train teachers to use computers?

* Should computer education be taught as an autonomous discipline or should the computer be used as a pedagogical tool in all subject matter areas and be counted upon to introduce elements of information science indirectly?

* What is the optimal age for learners to begin computer education?

* What opportunity will those who are not in school have for computer education?

* Are developing countries making effective use of limited and scarce resources?

* Is it possible to use CAL in developing countries to solve or alleviate some of the problems encountered in education?

* Is it possible to use such a sophisticated manifestation of technology as CAL for the training of people who are mostly living and working in conditions far removed from modern technology?

These questions and concerns expressed by Third World educators at the World Conference are all partly addressed in the study that follows. The final chapter also includes suggestions about ways that the present research, specifically, and CAL, in general, may offer answers to such questions.

Educational Problems In The Third World and the Present Project

Many educational problems exist that are unique to much of the developing world. The ways microcomputers can be used in the teacher training process to

possibly help solve some of these problems will be the focus of the following section. The problems will be listed and then discussed within the context of the present study.

1. **Expanding numbers and limited funds:** A twenty-year effort to expand schooling in the Third World has largely succeeded; in 1960 there were 144 million pupils in the primary and secondary schools of developing countries (excluding the People's Republic of China and North Korea). By 1976 the number had reached 335 million. Even in relative terms, the figures are impressive: 46.8% of 6-11 year olds in developing countries attended school in 1960 and 61.8% in 1975 (UNESCO, 1980).

But at the same time, the absolute number of illiterates in the Third World has increased (World Bank, 1980); the poorest 50 percent of the population remained essentially as poor as before; income distribution, if anything, became more unequal (Adelman, 1973); and unemployment increased (Carnoy, 1978).

Table 1.1 shows the school enrollment ratios for different regions of the world (deWet & Calitz, 1981).

TABLE 1.1

WORLD SCHOOL ENROLLMENT DATA

(Percentages of relevant age group attenders)

Region	Primary Schools %	Secondary Schools %	Higher Education %
North America	98	92	44.5
Europe & USSR	97	64	16.7
Oceania	95	60	15.0
Latin America	75	35	5.0
Asia	55	30	4.7
Africa	40	15	1.3

It is apparent from Table 1.1 that developing countries must still build schools and find teachers for two to three times as large a section of their populations as the industrialized countries. In an attempt to close this gap, many poorly trained teachers have been rushed into classrooms. The Malaysian project of using computers to train teachers, both inservice and preservice, potentially offers aid toward solving the problem of teacher training costs. This aid will be explained in detail in a later chapter.

2. **Untrained teachers and a shortage of teachers:** The shortage of well-qualified teachers severely retards the introduction of universal, free, compulsory primary education. With limited funds available to most developing countries, it is almost impossible to train enough people to teach the increased numbers of primary school pupils. Often members of the teaching force possess little more than a primary school education (Wood, 1974), are unqualified, or are on a level only slightly higher than the pupils they are to teach (Edstrom, 1973).

The demand for training and retraining is obviously great. This project has been an attempt to use computers in the training process. While it was not the aim of the project to teach subject matter per se, it did attempt to develop in teachers a positive attitude toward and command over computers along with increased problem-solving abilities that could perhaps carry over to other domains of their teaching careers. The project was

founded on the expectation that if the computer classes proved effective, further incorporation of this strategy in teacher education programs could be more cost-effective than the present modes of instruction for certain aspects of teacher preparation.

3. Poor teaching conditions: It is evident that teaching will suffer if teachers are not well trained. Effective teaching is also hampered by a need for school buildings, instructional materials and textbooks (Brickman, 1972). Teachers often work under conditions of great difficulty in overcrowded classrooms with the barest minimum of simple teaching aids (Wood, 1974). The result is that the quality of teaching is often low (Arnold, 1976; UNESCO, 1978).

Poor teaching conditions are also reflected in pupil-teacher ratios. From Table 1.2 (compiled from UNESCO, 1978), it is evident that the situation is worse for developing countries than developed countries or the world at large. A major goal of this study is to investigate the potential of using microcomputers to upgrade teacher skills.

TABLE 1.2.

PUPIL-TEACHER RATIOS

(UNESCO, 1978)

Region	Primary Schools	Secondary Schools	Higher Education
Africa	39	24	15
Developing Countries	34	21	15
Developed Countries	21	16	14
World	30	19	14

When teachers gain skill in developing lessons and programming computers, it is hypothesized that they will be better prepared to meet and solve the problems outlined above (e.g., expanding numbers, limited funds, and minimal basic literacy). Although it is nearly impossible at this time for the teachers to use a computer in their schools, the problem-solving techniques learned in the project's classes may carry over to improve teacher performance in the classroom.

4. High drop-out rate: There is a very serious drop-out problem in the primary schools of developing countries. In Asia the median drop-out rate in primary schools is 20.2%. In Africa it is 54% (Todaro, 1977). High drop-out rates for primary schools have always been a feature of rural communities (Elliot, 1975; Carnoy, 1982). The poor quality of education is mentioned as the primary reason for this high drop-out rate (Curle, 1973; Eliot, 1975). Other factors are economic conditions, poor physical condition of the pupils, large classes, shortage of textbooks, and unqualified teachers. The high rate of drop-out in rural areas is a major reason that the present project focused on teachers from rural communities.

5. Other problems: In the past curricula and syllabi have not been well integrated with the culture of the people served by the specific educational systems. The extent to which colonial influences still dominate the curricula of many developing countries indicates the historic lack of consideration for the local cultures. Textbook examples and illustrations are often culturally biased toward Europeans. The present project took steps to ensure that the materials developed were geared to the language

and culture of the teachers involved. These steps included translating computer languages, documentation and curriculum materials into Bahasa Malaysia, and arranging that course assignments be completed in Bahasa Malaysia. Course objectives and goals were created in conjunction with education professors at the Malaysian National University. Further details of the steps taken will be found in Chapter 3 which discusses the project's chronology.

Education in much of the Third World is characterized by an overproduction of humanities graduates and underproduction of engineers and doctors (Carnoy, 1982). This overproduction is caused by lack of interest by both students and primary school teachers in mathematics and science. By introducing educators to computing, we can hopefully improve their attitudes toward technology, mathematics, and computers, and encourage these educators to spur their students to an interest in technological fields. Results of attitudinal questionnaires can be found in Harper, 1984.
Another problem is poor research and development capabilities, especially in relation to technology. As far as I could ascertain from Ministry of Education and University officials in Malaysia, this project established the first educational computing facility at a university in Southeast Asia, and thus in a small way may serve as a stimulus for further research in educational computing in the region.

Another common problem in developing countries is that governments tend to discriminate in favor of secondary or higher education (Irizarry, 1980) when providing fiscal support for schools. Once again, the principal focus of the project was in investigating the use of CAL with primary school teachers.

Although many other problems such as elitism, sexism and racism exist in the developing world, this project concentrated on those problems computers might have the most immediate influence on solving.

Summary

According to UNESCO Director General Amadou M. M'Bow, "All countries have a primary responsibility to educate their citizens in computer literacy and in the application of that knowledge. It is important for all individuals everywhere to act with good conscience and solidarity, because the computer can unleash powers hitherto unknown" (Charp, 1984). Despite the Director General's concerns and the problems outlined above, very little is being done in the developing world concerning the use of computers in pre-college education or teacher training.

In a February, 1984, conversation that I had with the technical advisor of the United Nations statistical office, Dr. George Sadowsky, he stated that in recent meetings with numerous UNESCO officials he found no evidence of any work being conducted in the area of precollege education. With the United States withdrawal from UNESCO and with predicted heavy budget cuts looming, future work in this area seems unlikely.

Discussions with officials of the Rockefeller Foundation, World Bank, and Asia Foundation have yielded similar reports of a lack of support for computer-assisted learning for preservice or inservice teacher education. A few isolated studies have been or are now being conducted in the Third World (e.g., Senegal, Swaziland, Brazil, Argentina, Papua New Guinea and South Africa.) Results of these studies have not been published but will be mentioned in later chapters as they apply. Much of the work in this area seems to be following the pattern of CAL in the United States: a few teachers (primarily expatriate university professors in developing countries) buy a computer and bring it into their classes for students to use. In the United States this led to students and parents becoming interested in computer literacy. Teachers, parents and children in the United States are now pressuring legislators and school boards to integrate

computer literacy into the curriculum in grades kindergarden through 12.

Already the majority of schools in the United States are using computers in K-12 education (MECC, 1983 & Center, 1984). A growing number of states require computer literacy courses of teachers for teacher certification, and many developed countries (e.g. France, England, and Holland) are initiating massive computer literacy campaigns. In contrast, few parts of the developing world (which possibly could most benefit from technology and improved educational systems) are initiating or even contemplating the use of computers to improve their nations' schools. The information gap between the "haves" and "have nots" (Molnar, 1978) is widening. In addition to the potential of CAL for solving the previously mentioned problems, this gap and the subsequent consequences of becoming informationally and technologically poor are possibly the best rationale for the present study.

CHAPTER TWO

CHRONOLOGY OF THE PROJECT

This chapter opens with an explanation of events leading to the commencement of the project. Such information is included in hope that it may provide guidelines and precautions for anyone designing similar research or projects. Subsequently, a description is offered of the classes taught with the aid of the computer.

Initial Proposal

Because of my background and interest in international and computer education, I wrote a proposal letter in Fall 1981 about designing research to address many of the problems and questions concerning computer use in the Third World. I sent this short letter to eight people in developing countries (Fiji, Indonesia, Libya, Malaysia, Papua New Guinea, Malaysia, People's Republic of China, and South Korea) who had an interest in using computers in precollege education. Positive responses were received from all the countries, but Malaysia and Papua New Guinea showed by far the keenest interest and greatest willingness to begin immediately. Numerous proposals were also sent to funding agencies concerning financial support for such a project.

Papua New Guinea

As of October, 1982, the University of Papua New Guinea in conjunction with the Port Moresby Teacher Training College was prepared to supply the elementary teachers required for the study and an air-conditioned computer laboratory, along with housing and round trip air fares for my family, if I would train personnel, teach the proposed computer-assisted learning class, and supply all necessary computer hardware and software.

Initially, I felt the acquisition of the necessary equipment would be easy, considering the scope and potential importance of the research. The project required ten complete microcomputer systems at a cost of $15,000. In May 1983, after eight months of work and hundreds of dollars in phone calls, the possibility of equipment acquisition looked bleak. Only Apple Computer and the Atari Corporation were still saying "maybe." As the semester in Papua New Guinea was to begin in early July 1983, the prospects of conducting the project were beginning to look in doubt. Finally, after numerous meetings with its directors, Atari donated the required hardware and software.

During this time the project design was refined through correspondence with staff members at Papua New Guinea schools and through consultation with faculty members at The University of California at Santa Barbara. These preparations included setting forth the study design, describing the sampling scheme, describing in detail the data collection procedures to be used, and explaining the specific research questions to be asked, the time tables, and the computer laboratory design. Instruments were prepared to measure for both dependent and independent variables.

Airline tickets were purchased for a June 4 departure, equipment was shipped, and substitutes for my teaching positions were hired. On May 24 we received a phone call from Papua New Guinea saying that the project would have to be delayed indefinitely. The principal research officer who was leading the

effort to carry on the project told me that a new member of the government's cabinet had found out about the project and was angry that he had not been informed of it earlier. He then launched a crusade to stop the infiltration of computers into the country's primary schools.

The following paragraph is taken from letters from educators in Papua New Guinea and from direct notes from phone conversations with informed sources connected with the proposed project.

> "Six senior non-educated administrators went on a warpath and eventually there was no listening to reason. The Minister of Education, who originally approved the project, was forced to postpone the project indefinitely. The situation evidently exploded and fed off peoples' insecurity and ignorance. The opposition was suffocating the day and night attempts of faculty members determined to conduct the research. The opposition searched for issues to object to. They were very suspicious as to why an investigator would agree to teach classes for free and also donate thousands of dollars worth of equipment. Some objected to the fact that Atari equipment was being used. They wanted Apple or IBM. So many barriers were being thrown up in this sea of emotion that eventually there was no way around them."

Malaysian Project

The equipment was stopped in Australia. I did not want to lose the equipment before I had a chance to talk to officials at the National University of Malaysia where there was also a genuine interest in the project. The University's president, Tan Sri Awang had Salleh, was able to obtain funding from local foundations for air fares and housing, and he promised his school's cooperation. He was familiar with the project goals; and as one of Malaysia's leading educators, he was extremely interested in conducting the country's initial CAL research at his university.

The mailing labels were changed on the equipment, and it was shipped to Kuala Lumpur. I was informed that the semester at UKM (Universiti Kebangsaan Malaysia) would start on July 4. The earliest we could arrive in Malaysia was June 24. This would give us only two weeks to prepare for the course as envisioned in the original Papua New Guinea proposal.

The first few days in Malaysia were full of unpleasant surprises. These included:

* UKM trained only secondary school teachers, not the primary school teachers for which the project design had been geared.

* The nearest primary teacher training facility was 40 miles away, and there was neither money nor time to transport teachers to UKM.

* The term did start on July 4 for all the university except the education department, which had already been in session for two weeks. Therefore, it was impossible for any student to take a full semester course at this time.

* During my proposed time of stay there would be a three-week period when the students would be away student teaching and a one-week national holiday.

* The only member of the Education Department staff who was capable of or interested in working with me on the project was already doing the

work of two teachers (the other was studying in the U.S.), analyzing a major statistical research project conducted by the department, supervising the student teaching of all the mathematics and science students, and recuperating from a serious illness.

These problems would not have been nearly so severe if it were not for the sudden necessity of transferring the project from Papua New Guinea to Malaysia. There was little time to plan a study design that would meet the specific needs of Malaysian education before our arrival. On the positive side, the equipment had arrived in good shape from Australia, and the construction of the computer laboratory was given top priority.

On June 28, 1983 I had a meeting with the director of education, Dr. Ibrahim Saad, and the mathematics supervisor, Mr. Khalid Abdullah, to prepare a study design that would answer as many of the aforementioned questions as possible. After a lengthy and fruitful meeting, the following research design and time line were decided upon.

Study Design

The original intention of the project was to work with primary school teachers from a variety of disciplines. As the computer laboratory was going to be empty for three weeks during the semester, I proposed that during this time an intensive 15-day workshop be offered to primary school teachers in neighboring schools. Because of double sessions in most schools, the primary teachers are in the classroom either in the morning (7 am to 1 pm), or afternoon (1 pm to 7 pm) making it possible for them to attend workshops when they were free.

After checking with the Ministry of Education, we learned that this proposed three-week project was permissible so long as the workshop did not take teachers out of the classroom, it did not cost the Ministry any money, and the primary teachers that attended did so strictly on a voluntary basis. Plans went ahead to have the workshop in early September when the secondary student teachers would not be needing the laboratory. As I did not know how many primary school teachers would volunteer, two classes were also planned for UKM students.

The students who participated in these classes were either student teachers or teachers. The remainder of this book will use the terms "teacher", "student," and "participant" interchangeably.

Description of Three Classes

Briefly, the Computer - Assisted Learning Project (CALP) at the Universiti Kebangsaan Malaysia consisted of the following three pilot courses:

1. **CAI for the Malaysian Secondary Classroom** -One aim of this course was to determine if quality computer-assisted instruction (CAI) in various disciplines could be produced in the Malaysian language by secondary diploma students. Whether this course achieved the goal is not discussed here. However, this research did investigate a group of variables to determine which factors contribute to success in programming and how the student teachers felt about the value of such a course. (See Harper, 1984.)

   The rationale behind these objectives is that before a country's educators are to implement computers into their curriculum they first must know if quality educational materials can be produced in their language of instruction and geared to local syllabi. Additionally, programmers coming from the teaching community are needed to produce the software for conducting a serious CAL effort on a nation-wide scale. This class and the resulting information could suggest ways to identify teachers who show talent in computer-related activities and could determine what background factors may lead to success in such a program.

The CAI course consisted of eight hours of instruction plus computer laboratory time as needed to complete the assignments. The students used the PILOT computer language in the class. The student teachers were working toward completing two major projects: a test and a tutorial in their subject area using Bahasa Malaysia. In addition to students learning technical programming skill, criteria for producing quality educational software were discussed by the participants during the course. Not only were programming skills to be developed during the course but it was important for the participating teachers to incorporate good educational practices into their lessons in order to produce effective CAI.

2. Logo for the Secondary Mathematics Teacher - The main objectives of this course were to enhance the participants' basic mathematical skills, develop their problem-solving abilities, and improve their techniques in mathematics lesson design. To achieve objectives, students were to learn programming and use of the computer language Logo. The need to upgrade teachers' mathematical skills and teaching prowess weighed heavily when these course objectives were created.

One question the secondary Logo course hoped to answer was whether Logo programming techniques can improve the participant's ability to teach mathematics and science by their use of a discovery approach and the realization of the value of learning from errors. Additionally, the importance of certain key variables regarding the participants' ability to program in Logo were to be investigated; student programs were to be analyzed for changes in thinking patterns; and student reactions toward the pilot course were to be solicited.

The course consisted of eight 75-minute lessons plus computer laboratory time necessary to complete assignments.

3. Computer-Assisted Learning for the Malaysian Primary School Teacher - The key purpose of the primary Logo course was to determine under what conditions microcomputers could be successfully used with inservice primary school teachers in developing nations. Once again, improving the teachers' skills in teaching mathematics with the aim of developing mathematical skills in their students was a consideration for creating the course. Investigating Logo philosophy as it applies to teachers in a developing country was also an objective.

Teachers from rural Malaysian schools attended a 15-hour workshop spread over three weeks. The workshop consisted of learning to program using the Logo programming language. A special version of Logo was created so that all commands given to the computer and programs written for the computer were in Bahasa Malaysia. Another major objective was to use Logo programming to introduce different methods and strategies for teaching mathematics to students.

As experienced teachers, the participants' reactions to the relevance of such a course were most useful. Unlike the preservice teachers who participated in the other two courses, these experienced teachers were familiar with classroom activities and could better judge what was most beneficial to them. Extensive data was collected to answer questions concerning what variables contributed most to the teachers' success in educational programming, with success determined by the score on a final examination. (See Harper, 1984.)

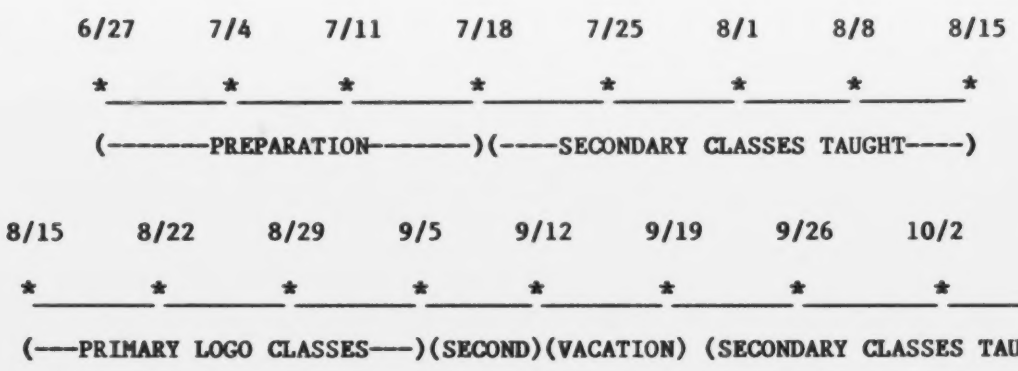
Time Line

The following time line shows graphically the sequence of events that took place during the project period. A brief explanation of each phase is given below. A more detailed description of the problems and results at each stage of

the time line will be discussed in the next chapter.

Table 2.1

Time Line of Malaysian CAL Project - 1983


6/27 7/4 7/11 7/18 7/25 8/1 8/8 8/15
(-------PREPARATION-------)(----SECONDARY CLASSES TAUGHT----)
8/15 8/22 8/29 9/5 9/12 9/19 9/26 10/2 10/9
(---PRIMARY LOGO CLASSES---)(SECOND)(VACATION) (SECONDARY CLASSES TAUGHT)

Preparation

The three-week preparation required the following major tasks if the participants were to achieve the course objectives and if trustworthy research results were to be collected. A rationale and a more detailed discussion of many of the following tasks appear in Chapter 3.

* Equipment and computer laboratory preparation
* Objectives and lesson plan generation
* Translation and translation verification of all student instructional materials and testing instruments
* Translation of the computer language Logo into the Malaysian language
* Selection of students for course
* Meetings with Administration, Ministry of Education, and American Embassy staff
* Meeting with Atari officials concerning equipment maintenance
* Initialization of diskettes and preparation of filing folders for the participants.
* Photocopying all student instructional materials and tests

A graduate student from the Universiti Pertanian Malaysia, Mr. Ismail Abdullah, was interested in the project and supplied many hours and valuable expertise to make all stages of the process a success. Between Mr. Ismail and Mr. Khalid, the translating and creation of meaningful courses took place in a short period of time. This was accomplished by giving the materials to be translated to faculty who were fluent in both English and Malay. I would then give the Malay translation of the English materials to another member of the faculty and ask for the reverse translation. Discrepancies were corrected and final translations typed for the class.

Course lesson plans were perused and discussed with faculty members. A few alterations were made to match local syllabi.

Complete lesson plans (objectives of each lesson, strategies, assignments, etc.) will not be give here but can be found in Harper, 1984. (This paper also contains a brief discussion of the topics covered and assignments given to each class along with rationale for the kinds of lesson plans developed.)

Classes

Secondary Classes - Both the Secondary Logo and CAI classes met for four weeks, followed by three weeks off, one week on, another off, and then three final weeks back in the class. This situation was definitely not ideal but was the best that could be managed under the circumstances. Ideally, an entire semester course with little interruption would probably have yielded better results from the participants. Three sections of the CAI class met weekly with 12 students in each, while two sections of the secondary Logo class were held weekly.

Primary Classes - The three-week intensive workshop took place during three separate daily class periods. The one-hour sessions took place at 10:00 a.m., 2:00 p.m. and 3:30 p.m. Each teacher in each class had his or her own computer to use during both lectures and laboratory sessions. This was not the best of situations, but weekends, nights and vacations were not times when teachers would attend the class. In addition, the teachers would not take the class during their work hours. Because we had only 10 computers, we were required to offer three classes and schedule each class only one hour per day. Two-hour classes would have been better, for that would have allowed each participant to complete longer tasks without interruption.

Follow-up

As I had to return to teaching duties in the U.S., there was not enough time to complete all the follow-up work I had originally hoped to do. In part this was due to the numerous unexpected holidays and days off. The days off were mostly spent in writing a project summary for the Ministry of Education, UKM administration, and the Malaysian American Commission on Educational Exchange (MACEE) which helped fund the research. Time was also spent giving seminars to Department of Education staff on how they could use the laboratory and also briefing Mr. Khalid on laboratory procedures. Back-up copies (both diskettes and hard copy) had to be made of all the students' work in case something happened to the originals while they were being transported back to the United States.

Summary

The events of this chapter spanned a period of two years, from the inception of the project through the development of course goals, objectives and time lines. Three diverse courses were developed to investigate the effects of using computers with a variety of teacher populations. These three groups consisted of (1) secondary preservice teachers from a variety of academic disciplines participating in a course designed to train teachers to write computer-assisted instruction, (2) secondary preservice teachers who majored in mathematics or science participating in a course designed to use Logo to study mathematics and science principles, and (3) elementary inservice teachers participating in a course designed to train teachers to program and investigate mathematics principles using the Logo programming language.

CHAPTER THREE

SUCCESS FACTORS

This chapter provides a list of considerations for those educators or researchers in developing countries who wish to implement computer education for elementary and secondary school teachers. A major purpose of this book is to discuss what conditions are necessary to successfully train teachers using microcomputers in a developing nation setting. The following discussion has been separated into three categories: administrative considerations, equipment and facilities, and classes.

Each category is built around key principles that educators may wish to consider. The discussion of each principle will be organized in the following manner.

1. **Principle (standard)** - A statement of the principle will be given.

2. **Typical Developing Country Conditions** - How are developing countries in general dealing with the educational principle? The conditions and problems mentioned in this section are either from the author's personal experience or have been gathered from recent comparative and international education books and journals dealing with general information about education in the developing world. [1]

3. **The Malaysian Project** - Conditions as they were found to exist in Malaysia will be discussed relative to the principle involved.

4. **Adjustments to Conditions** - Attempted solutions to any problems encountered, and how and why the solutions did or did not work out, will be the focus of this section. Suggestions of what else might be done will often be included.

While in Malaysia, I recorded notes daily, both in a notebook and on cassette tape. All student programs and work on the computer were stored on mini-diskettes.

Administrative Considerations

Administrative Support

Standard: Support for computer-assisted instruction at a high level of the educational hierarchy is essential for initiation and implementation of this type of research.

Typical Developing Country Conditions: The Papua New Guinea experience described in Chapter 2 is often encountered when dealing with developing countries. Bureaucratic bickering, jealousies, and poor flow of information are

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[1] Carron & Ta (1980), Gumbert (1981), Ankrah-Dove (1982), Ignas (1981), Thomas (1983), Postlethwaite & Thomas (1980), Asmah & Noor (1981), Musgrove (1982), Guthrie (1982)

problems one often has to deal with in a developing nation.

Conditions in Malaysia: In Malaysia this support existed from the Prime Minister (who publicly supported the use of computers in education in his speeches), through the Ministry of Education which gave permission for the study, and on to the National University's chief administrator whose efforts were critical in obtaining the funding and facilities needed.

Adjustments to Conditions: Myself, the University chancellor, and members of the University's education department all made sure that all relevant agencies were informed about the project and how it coincided with national educational policies.

National Computer Survey

Standard: A survey should be conducted to determine what has been done previously in the country regarding teacher training using computers. If others had experience with dealing with teachers, education and computers, then advantages may be gained from their know-how.

Typical Developing Country Conditions: It is often difficult to ascertain what research and pilot courses have been offered in the country. Some programs take place in private missionary or technical schools that do not report to a central ministry. Communication between schools, teacher training colleges, and offices of education may be cumbersome. Sources for information include newspapers, ministries of education, and teacher training centers. Many education ministries have research units where all projects conducted by foreign researchers are funneled.

Conditions in Malaysia: Information about previous related research is very easy to obtain in Malaysia as the nation has a relatively free flow of information. Most educated people speak English, daily English newspapers report on educational innovations, universities and teacher training colleges have centralized administrations, and education in Malaysia is given a very high priority both publicly and monetarily.

Adjustments to Conditions: I first went to see the director of Malaysia's sixteen training colleges for primary school teachers. He told me that not one of these colleges had a computer course for their teachers, but that a workshop was being organized in which faculty representatives from each college would meet in September, 1983 to discuss educational technology in general. Plans were tentatively made to hold part of this workshop at UKM in the educational computer laboratory. However, the funding for the workshop was not provided, so no workshop was held.

Although no university education department where secondary teachers were trained had a computer laboratory or course, representatives of University Sains Malaysia (science university) in Penang and University Pertanian Malaysia (agricultural university) near Kuala Lumpur reported that they were planning to initiate computer experiences for their teaching-diploma candidates in the future.

As far as I was able to determine from the Ministry of Education's research unit officials and news releases, only a few technical high schools were using computers in their curricula. However, there may also have been computers in a few private schools.

Relations with Faculty and Staff

Standard: Even though officials in the national educational hierarchy may support the project, computer education will run more smoothly if the local education faculty and staff are also supportive. Assisting in translating, coordinating goals with local syllabi, scheduling classes and laboratories, and organizing a work calendar are some of the areas in which faculty cooperation is helpful. Cleaning the laboratory, typing, photocopying, accepting telephone

messages, and maintaining security are areas in which the staff can help ensure success.

Typical Developing Country Conditions: University faculty and staff in developing countries often look upon foreign researchers as intruders and "know-it-alls." Distrust and jealousy are common feelings held by educators in the Third World. Many of these feelings may be justified from past experiences with foreigners who demanded too much or were insensitive to local conditions and cultures.

Condition in Malaysia: I had difficulty interesting faculty members in the project throughout the course. In one three-month stretch, not one member of the education department even entered the laboratory; some expressed an interest and made arrangements to see me, but none came. I felt at first this was because the professors and lecturers were overloaded with their own work or that they were basically humanities-oriented and not interested in computers.

Near the end of my stay, I learned that the faculty and staff had felt negatively toward the project even before I arrived. Some animosity was caused because the institution's general budget had been cut and pay raises frozen. In addition, monies to attend foreign conferences had been eliminated, and the faculty felt that the money used to establish the computer laboratory and support this project could have been better used to fill their own needs. They may not have realized that all computer hardware and software had been donated, that I taught the three classes without pay, and that the supplies, books, housing, and my air fare had been paid for by outside grants.

Because I was a graduate student gathering data for a dissertation, some faculty members seemed to feel that I was in Malaysia only a short time to "grab the data," not really to help them or their students. I was told on numerous occasions that had I been a visiting professor with a Ph.D., then I would have been treated with greater regard. I was the first researcher ever to do such a study at this new university and therefore somewhat of an oddity.

Adjustments to Conditions: I tried to better my relationship with faculty members by posting announcements and student work in the faculty room and offering seminars in the computer laboratory. By the time I left Malaysia, the atmosphere in the department had improved. I was getting invitations to dinner, faculty members were coming to the laboratory to ask questions, and the department gave me a banquet and gifts before I left. I concluded that this turnaround was partly due to the enthusiasm of students who took the course and because I made an attempt to learn and speak Bahasa Malaysia.

I found through discussions and seminars that many faculty members are interested in using computers to do word processing. Having word processing workshops and machinery available for faculty use are two things educational planners might consider as ways not only of increasing the quality and quantity of written output, but also of improving the faculty and staff attitudes toward computer use.

Course Continuity

Standard: Student progress toward the goals are best ensured when the class sessions are scheduled regularly and students attend regularly.

Typical Developing Country Conditions: Developing countries tend to have more situations arise which can cause course discontinuity than do the developed ones. These situations included many holidays, power outages, monsoons, coups, and illness in understaffed faculties. There also tends to be a lack of long-range, reliable planning.

Conditions in Malaysia: A major problem was the continuity of the course. The Education Department at UKM did not begin classes on July 4, as I had understood; classes had already begun by the time I arrived on June 24. This forced us to offer only an eight-week mini-course tacked onto an already heavy student schedule. These eight weeks were interrupted by a three-week student

teaching assignment, a one-week Moslem holiday, a one-week UKM holiday, and numerous other days off. Many of the days off were not announced until a few days or hours before they took place. These breaks made it hard for the students to remember from one class period to another all they were doing.

A course of this nature would most profitably meet for an entire semester because of both the inexperience of the participants and demands of programming classes (trial and error, graphics, debugging, discovery). Planning a course as much as possible around school breaks is a major consideration when designing the class schedule. Unlike most other courses, the student has difficulty doing computer programming without a computer and cannot be given many take-home assignments.

Another related point is that numerous prayer times during the day kept Moslem male students occupied several hours a week. Certain times of the day and Friday afternoons would find only female students using the computer laboratory. The fact that the female students were producing better materials can perhaps be accounted for, at least in part, by the extra time the women spent in the laboratory.

Adjustments to Conditions: Assignments and lessons were created with major breaks taken into account. Major assignments were due the day before a break. Homework that could be completed without a computer was given before the break. Review sessions were created during the first week back from a vacation or student teaching assignment for those students who wished to refresh their memory on previously taught material.

Future CAL Considerations

Standard Consideration should be given to the long-term future of the computer laboratory and course.

Typical Developing Country Conditions: Pilot projects are often undertaken without considering follow-up courses of action. Numerous conditions affect future planning: lack of money, lack of capable personnel, lengthy lag time in obtaining results from the original study, loss of interest when the foreign researcher leaves, and equipment failure. Few developing countries have a national plan that defines ways in which computers will be integrated into the nation's elementary and secondary schools.

Conditions in Malaysia: As anticipated, one of the major problems was that there was no planned follow-up course for those students wishing to continue their study of computer uses in education. A short course such as the types taught during this project can be valuable, but these experiences appear only to whet the appetite of those students who see computers as valuable for Malaysian education. Teachers gifted in this area can become rightly disappointed when further study is not possible.

Many teachers inquired about buying their own personal computer so they could continue to produce materials and use them with their students in their own classrooms. Educational planners may wish to consider centers that would provide students with information concerning careers and further studies in computer education.

Adjustments to Conditions: What would happen to the computer lab after I left was a concern of the Malaysian and American committee on Educational Exchange (MACEE), of instructors in the Computer Science Department at UKM, and of the course participants. I was willing to train personnel to continue the computer work but, as previously mentioned, none appeared to have the interest and/or time. I did submit a list of the most interested teachers who participated in the project, who, if they could gain more expertise, might possibly serve as computer laboratory directors.

Liaison with Other Academic Departments

Standard: Liaison with other academic departments interested in learning about computers can be of use in promoting campus-wide computer literacy.

Typical Developing Country Conditions: Academics in nearly every discipline are interested in how the computer can help them. They are interested in using modern technology in the development of their country. Unfortunately, funds are not always available for computer hardware, software, literature and consultants.

Conditions in Malaysia: Members of the physics, chemistry, and computer science departments engaged in long conversations with me on the uses of microcomputers in their areas. Faculty members and students from these departments visited the laboratory and sent observers to most of the class sessions. I consulted with these interested department members about strategies for department and campus-wide programs of computer education. However, the amount of time and work they expected of me did pose a problem.

Adjustments to Conditions: This problem was partially solved by giving the participants articles and books related to their interests. A well-stocked library of computer education literature is useful for any researcher doing similar work in a developing country as few up-to-date materials may be available, and materials in this rapidly growing field are soon out of date.

Communications Systems

Standard: Having adequate communication systems (e.g., telephone, telex, and postal) at the researcher's disposal enhances project success. In addition, reliable photocopying facilities or other copy services are useful when you develop and teach courses never taught before and where no printed material exists in the local language.

Typical Developing Country Conditions: Telephone and telex services in developing countries are often unreliable or non-existent. Sending information over a modem or service that depends on long distance calls may well cause problems. Postal service may not be reliable; postal workers have been known to take foreign letters for their stamps and/or contents. Power outages and lack of service to remote areas often prevent the use of electronic photocopying equipment.

Conditions in Malaysia: Attempts to telephone schools, the Atari office in Kuala Lumpur, or others often proved frustrating. It was very difficult to reach anyone on the telephone. This was because the majority of public schools in Malaysia do not have telephones and the entire university had only four outside lines. It took days to get local calls through, and foreign calls were all but impossible from the university.

Photocopying was not a problem during this study as machines were readily made available. Telex facilities were available at the University.

Adjustments to Conditions: Toward the latter part of the project a system was worked out with Atari officials in Kuala Lumpur to call me twice a week at a specified time. This helped guarantee some communication in case equipment failed. The postal service was reliable and communication to the United States was accomplished by mail. I planned periodic trips to Kuala Lumpur so that visits to key agencies could take place.

Communications between project directors and faculty and students were accomplished through notices on the bulletin boards.

Equipment, Maintenance and Facilities

Any project dependent on computer hardware and software needs to consider ways to keep the equipment functioning. This section will discuss principles involved in keeping equipment in working order.

Equipment Used During Project

The computer laboratory established as part of this project had the following equipment (most of which was donated by Atari Corporation).

* 10 Atari 800, 48K microcomputers
* 15 Atari Disk Drives
* 11 Hitachi color monitors
* 3 Atari Cassette recorders
* 3 Okidata Microline 80 printers
* 3 Atari printer interface modules
* 10 Atari PILOT cartridges and documentations
* 10 Atari Logo cartridges and one set of documentations
* 3 Atari Writer word processing cartridges and documentation
* 1 Master Type typing tutor program
* 2 Atari Pascal language systems and documentations
* 10 Atari Basic language systems and documentations
* 100 Verbatim floppy disks
* Numerous disks containing educational software.
* 96 cassettes containing CAI math programs
* Every current book on the Logo programming language
* Numerous journals, magazines and books relating to CAL
* Extensive office supplies

Nine large office desks were used as computer stations in the lab. The tables were wired to handle a computer, monitor and printer. Plenty of work and drawer space were available for the students. One computer used in front of the class for demonstrations was on a rolling cart that could be taken to other locations on campus. The tables were varnished and posters placed on walls in an attempt to create a pleasant as well as functional laboratory.

Back-up Equipment

Standard: Back-up equipment must be available to ensure smooth completion of a project that relies heavily on modern technology.

Typical Developing Country Conditions: Projects often wait months for repair and back-up equipment to arrive from another part of the world. A city of 70,000 people in Liberia once waited 18 months for the right generator part to come from Czechoslovakia so the city could have electricity. Competent repair and servicing people are frequently non-existent in a developing country

(Thomas, 1981).

Conditions in Malaysia: As no repair facilities existed in Malaysia for repairing Atari equipment, back-up hardware and software were necessary.

Adjustments to Conditions: Disk drives and printers seem particularly prone to malfunctions, so five extra drives and two extra printers were available, as were extra monitors and software. One advantage of microcomputers is that if one breaks down, the remainder continue to operate and the class carries on..

Arrangements were made with Atari Singapore to repair equipment. One computer and three disk drives did malfunction and were repaired and returned by Atari Singapore within a week at no charge to the project. With the help of Atari, I established close contact with the hardware manufacturer before leaving the United States. Through Atari, I made contacts with Hong Kong and Singapore to repair the equipment promptly and at no cost.

Pre-class Routine

Standard 1: In order to ensure that the equipment is functioning properly, a pre-class routine is desirable. Properly set-up equipment minimizes breakdowns.

Typical Developing Country Conditions: Teachers and university graduates everywhere often think that they can "figure out" anything. A computer novice may fiddle or experiment with the equipment and unintentionally ruin it. This condition was found to be true in Malaysia.

Adjustments to Conditions: Each machine was set to the desired language before class began. Although a brief explanation of the hardware configuration was given to the students, the possibility of equipment failure ending the research weighed heavily on this decision not to let the students load the software languages into the machine.

The disk operating system was explained to students but all storage diskettes were initialized before students used them. Before laboratory sessions some machines were prepared for PILOT. Laboratory assistants and staff members did operate the equipment but students were asked not to.

Although we did not want students to be afraid to touch the equipment, the staff decided that students should not be encouraged to "fool around" with the hardware as if they were experts. The three disk-drive malfunctions were a result of accidents caused by students.

A related problem is students "fiddling" with the equipment while the instructor is lecturing. A keyboard sitting in front of a student is very tempting to touch. The Atari computer produces a sound when a key is pressed which discourages students from typing during lectures. Turning the monitor off during lecture times seemed to help.

Safety of Media

Standard: Losing a long program or piece of commercial software can be disastrous both for the student and the project results in general. Care must be taken to ensure that media used to store programs and data be kept safe.

Typical Developing Country Conditions: Heat, humidity, dust and insects are typical conditions in developing countries that can adversely affect magnetic storage media. These conditions were all present in Malaysia.

Adjustments to Conditions: A good quality floppy disk was chosen for the project (Verbatim double density diskettes). A magnetically shielded carrying case was purchased for the project so airport metal detectors would not damage the disks. Disks were kept upright in an area of the class where no sun could reach them. No disk left the computer laboratory. Student handling of disks was minimal. Back-up disks were periodically made (see back-up policy principle in next section of this chapter). Not one disk caused problems during the

project, and not one piece of data was lost.

Standard 2: Chalk dust can wreak havoc on disk drives, printers and diskettes; hence, care must be taken when erasing chalkboards and handling diskettes after writing on boards to ensure that the equipment functions properly.

Typical Developing Country Conditions: Chalk used in developing countries is often of poor quality and creates much chalk dust which covers a wide area. Blackboards are also often rough, so more dust is produced.

Conditions in Malaysia: The microcomputer laboratory in Malaysia was faced with a chalk dust problem. Because board work in a programming class is essential, precautions had to be taken.

Adjustments to Conditions: Occasionally a student would have problems with his or her computer while I was using the chalk board. To prevent damaging a machine, I wiped my hand with a damp towel before going to the student's computer to help, because a teacher attempting to load diskettes with chalk on his hands may cause equipment failure.

Ideally, a porcelain board or overhead projector should be used in preference to a chalkboard. At any rate, a definite cleaning schedule should be arranged to keep the chalk dust from building up and possibly preventing the equipment from running properly.

General Consideration for All Classes

The following principles are academic considerations that apply to both the primary Logo and the secondary PILOT study. Principles that are specific to either class will be discussed after this general class section.

Time

Standard: The amount of time spent on a particular topic is of prime importance when designing lesson plans. The participant's work load, family life and cultural duties are factors that course designers need to consider.

Typical Developing Country Conditions: Courses are often taught without consideration of country or culture. Teacher training in developing countries involves upgrading basic skills to a greater extent than in developed countries. The workload is heavy for many of the students. In addition, computers are new to the vast majority of teachers in developing countries. Family, tribal and religious responsibilities also compete for the student's time.

Conditions in Malaysia: Few students in a Moslem country are willing to work in the evenings, weekends and during certain religious days and times. This, combined with the reality of only 12 hours of scheduled lessons, tended to work against a large amount of material being taught. In addition, numerous variables needed testing beforehand, and the students already had a heavy load of required courses.

Adjustments to Conditions: Laboratory times needed to be scheduled when students were free from other classes and functions; otherwise they simply would not have had the available time required to succeed in courses such as these. Religious and cultural influences were considered when scheduling work or planning lessons. Discussions with education faculty helped determine the amount of time each of the PILOT students could reasonable spend on the course.

Creativity

Standard: One of the characteristics a project of this nature hopes to foster is creativity. Being able to solve tasks on a computer requires a certain amount of creative thinking skills that are desirable in both programming a computer and solving life problems in and out of the classroom.

Typical Developing Country Conditions: A common characteristic of school-

ing in developing countries is the reliance on rote learning and courses taught by the lecture method. Students fear making errors and have difficulty seeing value in analyzing errors. Creativity is seldom necessary for a student to succeed.

Conditions in Malaysia: Many students wanted others to do their thinking for them; they did not seem to be used to thinking on their own and seemed surprised when I would only give them a hint or suggest three or four possibilities when they asked me a question. Students seldom answered my probing questions, especially in Logo classes. Students seemed to find it difficult to think during a class or when they were working with something new. Students seemed hesitant to discover and experiment; trial and error techniques were seldom attempted. Many of the students appeared to want cookbook solutions for what they were attempting, which would defeat the objectives of developing the thinking and creativity skills discussed earlier.

As the course proceeded and the level of ability among the students widened, it was impossible to answer all of the student's questions. In learning and teaching programming, I find there is a certain "hump" a student reaches when suddenly he "catches on" and begins to operate the computer successfully. Many students reached the "hump" while others needed more time than was possible in this study to achieve that level.

Adjustments to Conditions: Students had to be continually reminded to learn from their errors. I thought perhaps the students were not understanding me, but the results of the English verbal listening test showed otherwise. (See Harper, 1984.)

Finding a balance between telling the students the answer and, therefore, keeping them "happy" versus leading them to discover the solution themselves and possibly causing temporary frustration, is the classic dilemma that was faced in this project. I found that when this strategy was used to spur creativity, some students would turn to one of their classmates for help when they did not get a straight answer from me. This created the problem of classmates spending so much time helping others that they did not have enough time to complete their own computer work.

A major purpose of the course was to counteract the lack of creative thinking skills problem. Logo and PILOT seem to succeed in developing creative thinking skills. (See Harper, 1984.)

Grading Assignments

Standard: In a short course of this nature it is important that the instructor look at the student's needs each week. This allows the instructor to become more familiar with each student's work so when problems arise in the laboratory, help can be more individualized. By grading assignments quickly, the instructor acquires feedback which may help in reorganizing future lessons and assignments. This is especially important in short, first-time courses such as those involved in the present project. In addition, the students are likely to work harder knowing their efforts are being perused frequently.

Typical Developing Country Conditions: Classes are often large with little money or expertise available for assisting an instructor with grading programs and papers.

Conditions in Malaysia: Novice programmers continually need feedback. Understanding, evaluating and correcting someone else's program can be difficult and time consuming. In the Malaysian project the entire day was devoted to classes, laboratories and preparation time. There was little time to grade assignments.

Adjustments to Conditions: The grading was done by having the students hand in a printout or by my looking at the student's work on a diskette. With the help of a student assistant, each weekend I would print out the students' previous week's work and make constructive comments to each participant.

Administering Tests

Standard: Data collection is a major task of most research projects. Creating measuring instruments, producing copies of the instruments, giving the tests, and storing the results are all required steps for successful completion of a research project.

Typical Developing Country Conditions: Tests developed to measure a variable in the United States may not be appropriate in a developing country because of differences in culture, language, physical environment, and developmental level of the society. Educators in many developing countries are suspicious when a foreign researcher probes too much or too deeply. Finding times when all the participants can complete the test is often a problem because of participant illness, busy schedules, and religious responsibilities.

Conditions in Malaysia: Testing for the numerous variables in the study created problems both in finding time and trying not to make the participants feel like guinea pigs. If I gave a test at the beginning of the period, invariably some students would come late and have to take a make-up, whereas if a test was given at the end of class, I would be forced to stop a class just as the students were getting interested. To try to schedule a separate time when all students were available was impossible.

Adjustments to Conditions: Tests were scheduled so they would not require more than 25 percent of the class time. Pretests and tests of characteristics that could change through participation in the course were given first. Typing skills were tested during laboratory times. Students who were absent for a test were given a make-up test as soon as possible so that missing data would be kept to a minimum. Although the participants were tested extensively, not a single student complained about the tests.

Absenteeism

Standard: A student's progress and success can be adversely affected by absenteeism.

Typical Developing Country Conditions: It is often difficult for students in a developing country to attend classes regularly. Health problems, religious and family commitments, military duties, monetary problems and unreliable transportation are causes for absenteeism.

Conditions in Malaysia: In a course with such a limited amount of class time, an absence can cause a student to miss numerous critical concepts. The absent student invariably came in during laboratory time and wanted the instructions that had been given in the previous lecture section. By helping that student, the teacher needed to take time away from others in the laboratory who needed his help. If another student helped, then the helper lost laboratory time. Offering make-up classes would not encourage regular class attendance and would take up the instructor's time.

Adjustments to Conditions: To solve this problem, I would usually give the student who had been absent a quick explanation and refer him or her to appropriate documentation. Another help was for me to leave the class notes on the board for a while so that absent students and other class sections could use them. Reasons why students were missing were solicited and regular attendance was encouraged.

Typing and Keyboard Familiarization

Standard: Student progress toward successful programming requires a knowledge of typing and the computer keyboard.

Typical Developing Country Conditions: Typewriters are still not universally available in many developing countries. Learning to type is often not

part of a teacher's prior education.

Conditions in Malaysia: The typing skills of the majority of teachers were good. There are, however, differences between a typewriter and a computer keyboard that needed to be pointed out to the students in order to ensure a better transition into the programming segment of the course.

Adjustments to Conditions: The first lesson contained a demonstration and hands-on work with the computer keyboard. Laboratory time was spent showing students which key to press in a particular circumstance. A typing tutor program was translated into the Malaysian language and made available to the participants so they might practice typing skills.

Electronic Media

Standard: Students who are typing on a computer keyboard while the instructor is attempting to make a point may miss some information and disturb nearby students.

Typical Developing country Conditions: People everywhere have trouble keeping their hands off machinery that is placed in front of them. Malaysian teachers and student teachers were no different.

Adjustments to Conditions: I found that having the students type in a program while I was explaining it on the board had the effect of keeping the students involved in the class for the majority of the time period. This also encouraged familiarity with the keyboard and editing commands. Also as students continually listed and ran the program, they increasingly understood the concepts being presented. The difference between listing and running a program seemed to confuse some students. This problem was an additional reason for using this technique. Some slower typists had trouble keeping up, but for the most part this technique kept the class involved and active while giving them practice with the keyboard.

Back-up Policy

Standard: Using good quality disks and taking precautions to protect the work on them is imperative to ensure that important data and programs are not lost accidentally.

Typical Developing Country Conditions: In general, heat, humidity, power failures, theft and dust are more of a problem for using diskettes in developing countries than in developed ones.

Conditions in Malaysia: Security was usually tight on the University campus. The room was generally air conditioned during the hot part of the day. Power outages were rare. Nevertheless, the possibility of losing materials on a disk still existed.

Adjustments to Conditions: I did not systematically have students prepare back-up disks, but if I saw a student with a large program that he or she had spent many hours on, I would have the student use a specially marked back-up disk before leaving class. Students were also encouraged to save their work every half hour or so, as power outages in rainy developing countries do occur, although they occurred only twice during this project.

CAI PILOT Course Considerations

Attempting to teach computer novices to program educationally sound CAI during an eight-week mini-course is certainly a challenge under any circumstances. Listed below are observations dealing specifically with aspects of the PILOT CAI course for secondary preservice teachers. This section is intended for educational planners in developing countries who want to train teachers to write computer-assisted instruction.

Once again, I will give a general standard as it applies to this class. As

developing countries, including Malaysia, have had little or no experience with this type of course for educators, the principle will be followed by an explanation of how the standard (principle) was accomplished and what else might be done.

CAI Philosophy

> **Standard:** A course aimed at training teachers to produce computer-assisted instruction (CAI) can potentially contain aspects of the history of CAI, types of CAI, what elements make good CAI, evaluating CAI, and what research says about CAI.

While I spent some class time discussing the elements that make up good CAI, a manual written in Bahasa Malaysia may have been beneficial because then students could study the theory outside of class. (See Goodson & Lathrop, 1982.) Another suggestion is to produce a Malay version of the University of California at Santa Barbara CAI Module (Harper, 1981). This module contains on-line criteria for evaluating educational software and then proceeds to questions the user on various aspects of numerous representative CAI lessons. The advantage of this method is that students can learn at their own pace outside of class time, thus saving time while gaining valuable hands-on experience using CAI. It also demonstrates techniques they may wish to replicate and incorporate into their work.

It can be seen from the results of the final examination (see Harper, 1984) that few students had a grasp of what makes good computer-assisted instruction. Following the above suggestions might have improved their understanding.

Documentation

> **Standard** Computer hardware and software are better understood when clearly written in the native language of the user.

Although the Atari PILOT documentation is well done, it was not used by the students to any great extent. Part of the problem may have been that it was written in English. Important sections of the two manuals were translated and distributed to students, but entirely translated manuals might have been more helpful. I found that making one copy of each manual available in the departmental library and allowing students to photocopy sections to take home and study proved useful for some students.

Language

> **Standard:** Students perform better when they are fluent in the language of the instructor.

There were students whose listening comprehension of English was weak. They were quickly identified (most were Islamic Studies majors) and bilingual students were always placed next to non-English speakers during lectures. When students weak in English came in to work on their assignments during laboratory time, however, translators were not always available. At times this became frustrating for both the students and instructor. It may be wise for foreign lecturers not fluent in the local language to have bilingual laboratory assistants available.

This laboratory problem was partially solved by checking the laboratory sign-up sheets to find out what times the non-English speaking students would be coming in and having a laboratory assistant available. Eventually, my Malay improved along with their English.

Although the lectures and documentation were English oriented, the program-

ming itself was entirely in Bahasa Malyasia. Using the Malay language on the computer was a major objective of the study.

On-line Tutorials

> **Standard:** On-line tutorials, written in Bahasa Malaysia, similar to the Apple Co-PILOT (Apple, 1982) would be helpful to those students who miss lessons or who wished to review PILOT commands. Using CAI tutorial packages enables teachers to practice PILOT commands and syntax at their own pace and as often as necessary.

There was no time to write such a Malay tutorial using PILOT in the present study.

Graphics

> **Standard:** Graphics can be a great motivator for many students and can often be a valuable asset to a CAI lesson.

Although Atari generally has good graphics capabilities, Atari PILOT procedures for creating graphics are a bit complicated and cumbersome. Much "handholding" was needed here with special graphics summaries handed out to help the students succeed in placing appropriate graphics into their CAI lessons.

Demonstration lessons using many of the machine's graphics capabilities were shown and printouts made available to the students. They would then decipher the printout to find out how a certain effect they wanted to use was achieved. Other students would see it used in their classmates's program and learn it from them. I would have students write down in Malay how to achieve certain effects and then photocopy these descriptions for the entire class.

Making the graphics too complicated caused frustration with some participants; some students ended up with little more than a beautiful graphic in their tutorial. Making the screen visually pleasing was not an easy task for many students. Common problems were too much material on the screen and using the machine as an electronic page turner.

Despite some drawbacks with its graphics capability, Atari PILOT proved a more than adequate language for use in this setting because of its ease of use, especially the editing and file management capabilities.

Assignments

> **Standard:** Assignments given in a class of this nature should build on one another and allow for individual differences in style and interest.

Using the format of having students produce one test and one tutorial during the class generated numerous useful tests and tutorials. This book does not attempt to show or analyze the content of these CAI instructional packages; this will be the major topic of a future paper.

Although the tutorials were just too big a task for the time allotted, all the students got an idea of the problems involved in creating good CAI. Once students got involved with their tutorials, they seemed very motivated to finish. Laboratory hours needed to be increased as the due date approached. These laboratory hours became more work for the instructor as students' work became more diversified. However, as the deadline drew near, those students who were behind seemed to completely give up. Some students never realized that programming cannot be done at the last minute, and they were disappointed when they could not complete their work on time.

Programming

While it is not the purpose of this book to be a tutorial on how to teach PILOT programming, there were a few persistent problems. These problems are evident when one analyzes the results of the final examination; a detailed discussion of the final examination (which tested in part for programming ability) can be found in Harper, 1984.

Secondary Logo Class Considerations

This Logo class emphasized a new approach to the teaching of mathematics and science in the secondary schools.

Drop-out Rate

> **Standard:** Provisions should be taken to minimize the number of students who drop out of a course.

Of the 22 students who indicated from which university they graduated, 13 were from UKM while 9 graduated from foreign universities (mostly in the United Kingdom). All 13 UKM graduates dropped this computers in education course. The nine who completed the course were the nine who graduated from foreign schools. As computer education is very important in the U.K., perhaps the students who completed the course felt computers are important for them and Malaysia. The 13 UKM graduates possibly did not realize what computers are doing for education abroad.

Other possible reasons for the high drop-out rate are:

* **Lower English language abilities of UKM graduates:** This is probably a minor reason since most undergraduate mathematics courses at UKM are taught in English.

* **Weaker mathematics background of UKM graduates:** Although most students dropped out before I gave the mathematics aptitude test, it is possible that those students obtaining a B.S. in mathematics from an English university were better prepared and more confident in mathematics. This is also likely to be a minor reason as mathematical ability was never stressed in opening class sessions.

* **Lack of a computer background:** Most of the foreign graduates had used computers whereas only one of the UKM graduates had. Perhaps the UKM graduates were afraid of failure or competition with the foreign graduates.

* **Increased work load:** After the beginning sessions, UKM graduates may have felt the increased work load would adversely influence their other classes. Indeed, when asked why they had dropped the class, the unanimous reason was too much work in other classes. The foreign graduates had previous computer experience and may have felt the class would not require too much additional work. The fact is that 31 of 36 CAI PILOT students completed the course, and these 31 along with the 9 who completed the Logo course had the same class load as the drop-outs.

* **Lack of interest in becoming teachers:** It was known that some of the drop-outs were bitter because they had to teach for a period of five years to pay back the government scholarships which provided them

with a university education. Many wanted to go into more lucrative businesses. Perhaps they were not interested in using computers for educational purposes.

*** Sex differences:** Eleven of the 13 drop-outs were male while 7 of the 9 completing the course were female. The quality of the females in the department of education tended to be higher than that of males. (See Harper, 84.) Males have other opportunities for success (especially in a Moslem society), whereas teaching offers gifted females an area in which to excel.

Language

Standard: Student progress toward course goals is best ensured when their dominant language is used as the language of instruction.

After the programming language, documentation, tests, and final examination were translated into Bahasa Malaysia, many of the students said they would prefer English versions. Because all Malaysian university students learn mathematics in English, many did not know the Malay words for certain mathematical terms. To counter this problem, English versions of the documentation, assignments, tests and final examination were run off so the students had a choice of using English or Malay materials; most chose English. This only happened in the secondary Logo class which was made up entirely of students with B.S. degrees in either mathematics or the sciences.

Atari Logo

Standard: A well-designed, errorless version of Logo with advanced features is beneficial when training teachers with university degrees in mathematics and science.

Certain features of Atari Logo (Atari, 1983) were especially useful with these students; the capability of having multiple turtles that can be set to any speed and collision detection are two such features. This enabled the students to study calculus, physics and topological problems. These extended features are superior to the other Logo implementation systems I have used in the past.

Projects

Standard: A project-oriented approach is often beneficial when learning a programming language.

A list of 10 possible projects was given to the class during the fifth week. This 4-week assignment met the objective of allowing students to "go their own way" in true Logo fashion. I found that students working in pairs on a project helped reduce the workload of the instructor during laboratory times and shortened the time needed to complete the work. Not only were pairs of students able to help and learn from each other in class, but they also met when they were not in the laboratory to discuss programming and debugging strategies.

The projects as well as the required documentation were to be done in Bahasa Malaysia. Some potentially useful Logo demonstration programs in Bahasa Malaysia are now available in the UKM Educational Computer Lab (Makmal Komputer Pusat Pendidikan).

Problems

It is important to look at some other major problems that can occur in such

a secondary Logo course.

* **The mathematics abilities of the students were quite varied even though they all had a B.S. degree in mathematics or science.** Proportion seemed to cause problems for many. An assignment that required that a house be enlarged and shrunk caused the students difficulty.

* **Students had difficulty looking at mathematics from a Logo perspective.** They seemed hesitant to "play turtle" or use trial-and-error techniques. There seemed to be little carry-over from the lessons to the practical laboratory sessions.

* **Students had trouble with the Logo editor.**

* **Planning Logo lectures is often difficult because of the nature of the language.** Students learning Logo have the desired tendency to go their own way, the result being that lesson plans had to be altered while they were being delivered. The last four weeks were spent discussing problems that arose from the projects. New syntax and techniques were taught as needed during laboratory times.

Primary Logo Class Considerations

UKM is a recently built university located in a rural area. This provided the opportunity to recruit teachers who have taught in rural schools for many years. The following observations are intended to be useful for teacher trainers wishing to offer inservice computer education to primary school teachers in a developing nation.

Recruitment

Standard: Recruitment of teachers to participate in such a project must be carefully planned.

Ideally, the project would have involved randomly selected teachers who would be given time off with pay to attend this mini-course. As it was, we had to recruit volunteers to come during their own time for fifteen one-hour lessons while leaving their families and chores to do later. A great deal of effort was required by the teachers, to take a course in a subject that would seemingly be of little use to them because of lack of computer equipment in the primary schools. The fact that 16 teachers from five schools took the course says something of the dedication of this group of primary school teachers. It may well show the drawing power and mystique of the computer. This drawing power alone may be valuable in initiating a variety of inservice programs.

The recruitment strategy involved producing brochures stating the course objectives, goals and time schedule. Brochures were taken to each school headmaster. The only person available to help me find the schools was a janitor at UKM. He read the information sheet, and we discussed the project so he could answer any questions at schools where no one spoke English. The sheet announced two meetings at UKM where interested teachers could receive a demonstration of what the course would entail along with the opportunity to ask questions; teachers could then sign up for the mini-course. All in all, I found more expressed enthusiasm among these teachers than I have among the elementary teachers I have worked with in California. (See comparison of attitudes towards computers in Harper, 84.)

Of the 31 teachers who attended the meetings, 24 registered for the course. Sixteen of these came to the first class and 14 completed the course. Of the two who dropped, one became sick and other had baby-sitting problems with her children.

Participating teachers told me that many other teachers wanted to sign up but did not want to commit themselves to 15 lessons as they feared they would be lost if they missed one. In addition, many felt their poor English ability would hamper their success. It was explained that the programming, documentation and most of the instruction would be in Bahasa Malaysia, but evidently many still wondered.

Because the teachers were such dedicated and interested volunteers, the atmosphere was more exciting and spontaneous than was the case with the student teacher training at the university. This excitement was evident by the promptness, quality of discussions, and camaraderie that developed during the course. The primary teachers tended to cooperate and help each other. This contrasted to many of the preservice students who felt the mini-courses were just another class in the same university most had attended for years. For most of the primary teachers, it was the first opportunity they had had to attend a university. For this reason the Hawthorne effect (Roethlisberger & Dickson, 1939; Cook & Campbell, 1979) had to be considered. The primary teachers may have felt like pioneers and perhaps pushed themselves to do well. After their having taught for an average of 15.3 years, this experience certainly provided a change of pace for them.

Time

> **Standard:** The length of the course and individual classes should be sufficient to enable the average student to accomplish the goals.

One-hour lessons were not long enough; most of the students wanted to stay longer. As other sections of students immediately followed each class period, this was not always possible. There was also too little time to meet with individual students and discuss their problems.

One student felt he needed a computer at home to really learn the material. Printouts of their daily work enabled the participants to take their work home.

Language

> **Standard:** Student materials should be written in the national language.

With two months to prepare for this class, language did not seem to be much of a problem. Logo procedures had been written to ensure that most of the communication with the computer was in Bahasa Malaysia. The only exceptions were the diagnostics which were given in mixed English-Malyasian by the Logo program (e.g., "I don't know how to empatseki").

Much of the documentation had been translated, although the numerous reference materials on Logo were in English. Mr. Ismail Abdullah of UPM was a great help in both translating documents and teaching the classes.

Teaching Assistants

> **Standard:** Training local educators to assist the principal researcher is an important task.

Hours of Logo philosophy and Logo teaching methods preceded Mr. Ismail Abdullah's participation with the class. "Telling" the student too much destroys the discovery approach so central to Logo programming. This seemed to cause Mr. Abdullah the most problems, but his skill at guiding students was much improved by the end of the project. Training trainers is, of course, another major consideration for educational planners.

Relating Logo to School Curriculum

> **Standard:** It is important to gear the mathematical concepts presented to what the teachers are teaching in their schools. This practice provides feedback and attaches relevance to the mini-course.

In order to make the course relevant, the investigator had students design a school symbol and construct programs to use in their classrooms. This approach seemed successful because all students wanted to take what they had learned and developed to their school to show their staff and students. Although taking the teachers' programs into the schools was not part of the original plan, computers were taken to three of the five schools for demonstrations.

Dribble Files

> **Standard:** A record of all interactions between student and computer is potentially a powerful diagnostic tool.

An Atari Logo utility allows a record to be kept of everything a student enters into the computer. These records are called "dribble files." This is a valuable aid in analyzing a student's "mistakes" and progress. The question I struggled with was whether or not to tell students their every touch of the keyboard was being recorded. I felt that, if they knew they were being monitored so closely, they would be hesitant to experiment and discover for fear of making mistakes. Therefore, they never knew of the dribble files. The dribble files worked well; only twice did power outages destroy the day's files.

The contents of the dribble files are not analyzed in this book. An analysis of files for 15 Logo students from a different study with sixth graders can be seen in MIT's Brookline Report (Watt, 1979).

Programming Considerations

What follows is a list of observations concerning the Logo language itself. These observations were made during the primary Logo course and may be of interest to educators involved in or planning to teach Logo.

* **Editor:** I decided not to teach the editor until the fifth lesson. We were being very careful not to overload the students early in the course. Even so, many students took some time to understand the differences among the three models: immediate, edit and program.

* **Screens:** Full, split and text screens took a surprisingly long time for the students to comprehend.

* **Screen dumps to printer:** Being able to make a hard copy of a student's design may have been a good motivational tool. As it was, we were unable to figure out how to do this. I wrote Atari inquiring abut this, but received no reply. This was a problem in using a language that had not yet been made commercially available in the U.S.

* **Peer demonstrations:** Having the participants explain their procedures to the class in Bahasa Malaysia worked quite well. Some teachers "went overboard," explaining every word and step in the process; they seemed, for the most part, very proud of their programs.

* **Procedures:** Some teachers had trouble realizing that once a proce-

dure was defined, they could use that definition in subsequent procedures.

* **File management:** A mistake was perhaps made in teaching file management primitives (SAVE, CATALOG, POPS, POTS, etc.) in a single lesson. Two or three per day may have been a better approach as there was much confusion after this lesson.

* **Competence:** It seemed to take about two weeks (10 on-line hours) for participants to become proficient enough to use a modular programming approach.

* **Coordinate geometry:** It cannot be assumed that elementary teachers know coordinate geometry if it is not part of their teaching syllabus.

* **Homework:** Many of the participants found it helpful to write programs (procedures) at home and then type them in when they came to class. This saved time and also gave them an opportunity to think about their program away from the computer.

* **Laboratory visits:** Some of the participants wanted to bring relatives, friends and colleagues to the laboratory to show off what they were doing. I allowed this.

* **Certificate:** A certificate was produced (using Logo) for those who completed the class. Many students stated that this was important to them as they had something tangible to show for their work.

* **Demonstration disk:** A demonstration disk of the students' work and projects was created. This diskette can be used for motivational purposes for prospective participants in future training or as an argument in favor of further computer education funding.

Student Suggestions

In addition to the information collected through my observations, each participant was asked to answer the following four questions after having completed his or her course:

1. Describe the roadblocks you feel face Malaysia if this country is to use computers in the primary schools in the future. List some suggestions as to how Malaysia could overcome these obstacles.

2. What suggestions would you make that would improve this course for primary (secondary) school teachers who take the course later?

3. Describe how this course helped you personally. Do you feel that every teacher should be exposed to a course in programming PILOT (Logo)?

4. Would you be interested in an advanced course in PILOT (Logo) at a future date?

While the answers to the above questions become repetitious, this underscores the fact that students tended to agree on what problems existed and their possible solutions. Many of the principles and suggested solutions, discussed earlier in this chapter, were also a concern of the participants. The questionnaire was completed by all 54 teachers who finished the course. A summary of

the results follows.

The following roadblocks to computer education were mentioned frequently by the participants.

* Lack of money--all respondents mentioned this
* Lack of books
* Lack of teaching staff
* Lack of research programs
* Parents do not realize the importance of computers for development
* Lack of English skills
* Lack of interest
* Lack of educational software geared toward the Malaysian curriculum
* Not enough time to prepare teachers (lack of teacher trainers)
* Lack of electricity at some schools
* Lack of space for computer laboratories in schools (=overcrowded conditions).

The following suggestions were given as possible remedies to the roadblocks mentioned above.

* More money should be allocated to computer education.
* Schools and children should be encouraged to use computers (more interest cultivated among the citizenry).
* Training should take place in the Malaysian language.
* Computer courses should be prepared at all levels to train teachers how to use computers.
* Malaysia should produce its own microcomputer for educational purposes.
* The government should sponsor experienced teachers with higher education to go overseas to be trained in teaching techniques using computers.
* Courses in CAL should be inserted into the curriculum of all teacher training colleges.
* Mass-communication media should be used to encourage learning about computers.
* Pilot projects should be carried out in the elementary and secondary schools.
* Money should be procured from business and private organizations to fund CAL activities.

Most of the suggestions the teachers offered for improving the course can be placed in one of the following categories of responses:

* More time should be available to students. (This was the overwhelming criticism.)

* Additional laboratory assistants should be available.

* Longer laboratory hours should be available.

* The course should be conducted entirely in Bahasa Malaysia.

* This class should be an entire semester-long course.

* More documentation should be available for outside study.

The final question asked how the course helped the student personally. Most of the 54 responses would fall into one of the following categories of answers:

* I now know the powerful potential of computer use in education.

* I now can explain how easy the learning process could be using computers.

* I learned that the children of the future will be fortunate.

* I acquired skill in writing programs.

* The course gave me confidence in using computers.

* This course made me realize that computers are not as difficult as I had thought before.

* The course (Logo) gave me an interesting perspective on teaching mathematics.

* I learned that I now want to know more about computers.

Complete student answers to these questions can be found in Harper, 1984. Educators interested in conducting computer-assisted learning in a developing nation may find these student responses beneficial.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

Chapter 4 will summarize the Computer-Assisted Learning Project described in this book. I will give my conclusions as they relate to the Malaysian study. Then I will discuss possible implications of the study for educational planners in developing nations.

Conclusions from the Project

The overriding assumption of this study is that there is a genuine value in educating and training people in developing countries to work with computers. As illustrated in Chapter 1, numerous organizations and computer education experts agree that teacher training is the most critical step in the development of computer literacy programs.

For society to become computer literate, educators need to ensure that teachers recognize the importance of computers and their applications. The present study has suggested that English listening skills and, to a lesser extent, mathematical and spatial abilities, have significant influence on the ability of Third World teachers to understand the operation of computer languages such as Logo and PILOT. Hence, measures that can enhance learner skills in these areas may aid in promoting productive teacher and student computer use.

This project was an attempt to conduct a small experiment relevant to a typical teacher-training facility in a developing country. Most of the research dealing with Logo and CAI (e.g., the work of Papert, Suppes, and Watt) had been carried out in environments which were marked by advanced technological cultures and strong financial, technical and philosophical support. The Malaysian study, described in this dissertation was quite different. The learners were from cultural environments evidencing very little advanced technology; Malaysian sources provided little financial support; no repair or technical services were available in the country; and there was no teacher training center at which students could follow course work in computers.

Yet under these conditions, this study has shown that:

* Inexpensive microcomputers can be reliable.

* The teachers who participated in the course came away with more optimistic attitudes towards computer use in education.

* The majority of teachers learned to program and could produce CAI and Logo programs in the Malaysian language.

* Sex, family background, typing skills, previous use of technology, educational background and mathematics skills appeared to have very little to do with success in the course. Only English listening skills made a significant difference in the final examination scores.

Many educators who attended the World Conference on Computers in Education (see Chapter 1) felt computers could not be introduced into developing countries until basic academic skills were upgraded. This study seems to contradict this opinion as teachers succeeded despite factors in their academic background that

would seem to need upgrading.

Although the results seem to indicate that teachers in Malaysia, given adequate instruction and documentation in the Malaysian Language, can succeed in a computer course of the type given, an overly optimistic advocacy or partial analysis by educational planners in Malaysia and other developing countries may prove counterproductive.

Implications for Action

Many developing countries will have to make decisions concerning the extent to which computers will be used in their nation's educational systems. The major questions countries may wish to consider are: if, how, and when computers should be integrated into the education of its citizens. The answer to these questions will depend on a list of factors that will differ with cultures and time.

Three of the factors that can influence the extent to which a society will adopt computer-assisted learning are those of (1) key values in the society, especially in attitudes toward modernization, (2) traditional notions of teacher and student roles, and (3) financial resources.

In terms of values, a society may emphasize the importance of people over the importance of machines, according more significance to personal relations than to efficiency of production. In this event, the populace may reject the notion of computers as instruments that replace people in jobs. On the contrary, leaders in the society may seek to emulate the accomplishments of advanced industrialized nations and thereby welcome such innovations as computers. In Malaysia, this second attitude was prominent among the leadership, both within the Ministry of Education and within the National Malaysian University.

In regard to traditional notions of teacher and student roles, a nonindustrialized society may place high value on the teacher as the respected receptacle of knowledge and the student as the obedient recipient. In such a setting, computers may appear to be unwelcome intruders, ousting the teacher from his traditional role. In contrast, leaders of developing societies may wish to equip their teachers to become innovators, ready to adapt new technology for improving the efficiency of learning. In other words, the teacher can view himself not as being displaced by a machine, but rather as an expert in the new technology, still honored by students for such expertise. In this event, computers may be welcomed into the schools.

Finally, since computers and teacher training requires large expenses, the level of financial resources will affect how readily the society will accept computer-assisted learning programs. In Malaysia, at least at the national University, adequate financial support was provided. The financial resources, however, would not be sufficient in the foreseeable future to make computers readily available in most schools.

Education planners, officials, and teacher trainers seem genuinely interested in the potential of computers in education. Full support was given to the present study which emphasized training teachers to use computers and the upgrading of basic skills using computers. If a country wishes to take the Malaysian position, as other countries are, then they may wish to consider the following recommendations based on Malaysia's future plans and the results of this study.

Maximize Efficiency of Instruction. In the present study, the director of the research project spoke primarily English, and the major reference materials for use in the computer programs were in English. A heavy emphasis on English can be expected in many developing nations as materials and instructors from abroad introduce computer-assisted education. Therefore, one direct implication of the results of the present study is that under such conditions, the success of students in a training program will generally be greatest if the students are

already fluent in English. Hence, if a limited number of openings in a CAL program are available, then program administrators can profitably give priority to students who display English-language fluency.

A second implication is that local staff who are to become trainers in a CAL program, should be fluent in English as well as in the local language, so that the trainers can understand the English-language instructor and materials and can translate the CAL procedures for students who are not fluent in English but who still wish to participate in a CAL program.

Conduct Experimental Program: Educational planners may determine that a phased series of experimental programs aimed at replicating and improving the design of this research project would be beneficial. Problems encountered in Chapter 3 and further results found in Harper, 1984 (especially the influence of English) are examples of what could be considered and modified. The results of the student questionnaires may also be helpful.

Initially, a modest but adequate computer project may prove worthwhile. Each phase should include the training of specialists (UNESCO, 1975). In Malaysia, these experimental programs could ideally be carried out by Malaysian educators, perhaps those involved with the computer-assisted learning project described in this report. As indicated in Chapter 3, it is important to assign people who are directing these projects to a full-time position for six months or longer.

Promote National Educational Computer Centers: The establishment and promotion of national educational computing centers could act as an important vehicle for furthering computer education. In addition to developing goals for computer education, such a center could disseminate information to educators as well as provide assistance in manpower, material and aids. These centers can also be used to give correct information about computers so that students and the general public can be vaccinated against misinformation from mass media.

Clearly developing countries have many differences in their educational priorities, and these differences affect the emphasis placed upon computer use in education. The national educational computer center should define these priorities, hopefully taking into account the results of this project as well as past and subsequent research. The centers should make long range educational plans that take into account the use of computers as well as other instructional technology which make educational systems more productive.

Generate Computer Awareness: The competence level of existing teachers can possibly be enhanced by giving them adequate training in computer techniques. This can possibly be done through a carefully planned program which creates a general awareness of computer technology. The following quote from Charp (1975) summarizes the need for a general awareness of computers by society.

> As computers become more widely used, it becomes important for the population of a country to become aware of what the computer can do and cannot do. The computer is a very important force and must be understood, accepted and harnessed so as to become a useful tool in the society in which we live. Everyone should have an idea of the power of the computer so that he knows when and where a computer could be useful. Since the computer is going to play an important part in many professions, pupils going on to further education will be confronted by the computer. In the not too distant future, few fields will remain in which the computer will not appear.

Convert Training Material: The results of this study seem to indicate there

is a need for experience in "translating" the basic materials so that it is in every way appropriate for the Malaysian or developing country situation. Translating computer courseware, curriculum, languages and documentation should encourage computer training to take place within developing countries themselves.

Train Educational Technologists: Although technical experts from developed countries can be beneficial, foreign contractors or consultants cannot be assigned the total responsibility. There seems to be a genuine need for indigenous educational technologists who are sensitive to the new constraints and opportunities involved in projects of this sort and can work effectively with the other people involved.

Provide Access to Computers: One of the problems encountered (see Chapter 3) was that teachers who completed the course had no access to further their computer education studies. In addition, colleagues of these teachers were becoming excited about the use of computers in education but unless they bought a computer, there was no opportunity to learn. Providing more access to personal computers may take some of the mystique out of educational computing, thus, facilitating the transition to computer awareness and to computer literacy among educators.

Computer grants from commercial vendors to establish laboratories in locations accessible to teachers may be a possible partial solution.

Make a Long-Term Financial Commitment: Although grants and donations may be available, eventually any country seriously interested in using computers to train teachers or students will have to make long-term financial commitments. According to a UNESCO report (UNESCO, 1975),

> The development costs for course material, teacher material, computer applications, and the evaluation and student performance assessment instruments is much higher than the equipment investment. Unless an adequate financial commitment is made to software development, it would be better to make no hardware expenditures.

Hold Conferences and Seminars: Asking individuals from other countries to share their experiences can be valuable. Working seminars, especially to get people started, can be very important. A conference on computers in education should be organized with speakers coming from commercial concerns and schools and colleges of education throughout Malaysia. Displays of computer equipment and educational software could be part of the conference. The conference would be open to all interested teachers. Perhaps the vendors would be charged to display their wares and this money used to fund the conference.

Develop CAI to Train Teachers: Planners may wish to consider developing Computer-Assisted Instruction to train teachers and trainers about computer techniques. Much CAI exists in the United States that trains computer users to perform a variety of tasks on the computer. Although the initial effort needed to translate and produce these on-line tutorials in the local language would be long and costly, the number of people that could potentially benefit from them would eventually make this CAI cost-effective.

Encourage Existing Programs: Many universities in Malaysia and other developing countries are contemplating the introduction of computer education programs both for teacher training and general university computer literacy courses. Encouraging these efforts could reap future benefits.

Foster Increased Cooperation: Educational planners may wish to foster

increased cooperation and joint participation among UNESCO, AID, ASIA Foundation, Ministry of Education, commercial hardware and software producers, and other organizations concerned with educational technology.

Study Effects on School Culture: Effects of computers on the school cultures (teachers, students, administrators, etc) of Malaysia may prove beneficial. Many of the present project's participants asked to take some computers into their schools and demonstrate programs they wrote during the course. Although these demonstrations seemed quite well received, careful studies on the effect on school cultures may be advisable before computers actually enter the classroom.

Future Research Needs

In conclusion, the study reported here has demonstrated the feasibility of using microcomputers in teacher education programs of developing nations, with both inservice elementary and preservice secondary teachers. It is clear, however, that this one study touches only on a very limited set of the factors that influence the use of computers in the educational systems of developing societies.

What is needed next is further research in such settings to discover the most suitable ways to solve the problems of providing computer programs in indigenous languages, maintaining equipment in proper operating order, training staff members, aiding the populace in learning the nature of computers, fitting computer-assisted instruction compatibility into the existing classroom patterns, and the like. Of particular importance is the preparation of indigenous researchers to cooperate in, and ultimately to conduct such studies.

REFERENCES

Abelson, A., Logo for the Apple II, Peterborough, NH: BYTE/McGraw-Hill, 1982.

Abelson, A., & diSessa, A., Turtle Geometry, Cambridge, MA: MIT Press, 1982.

Adelman, Irma and Morris, Cynthia, Economic Growth and Social Equity in Developing Countries, Palo Alto, CA: Stanford University Press, 1973.

Aiken, L.R., "Attitudes toward Mathematics and Science in Iranian Middle Schools," School Science and Mathematics, March 1979: 29-34.

Anderson, Ronald E., "National Computer Literacy, 1980," Instructional Materials for Computer Literacy, National Science Foundation, and from Seidel et al., 9-17.

Apple Computer, Apple Co-PILOT, Sunnyvale, CA, 1982.

Ankrah-Dove, Linda. "The Deployment and Training of Teachers for Remote Rural Schools In Less-Developed Countries," International Review of Education, 1982: 3-28.

Arnold, Guy, "Courageous Decision to Launch Primary Education Drive," African Development, 10, 1976: 1285-1287.

Asmah Haji Omar & Noor Ein Mohammed Noor, National Language as Medium of Instruction, Kuala Lumpur: Dewan Bahasa dan Pustaka, 1981.

Atari Logo Reference Manual, Sunnyvale, CA, June 1983.

Atari PILOT Primer, Sunnyvale, CA, 1980.

Atchison, William, "Computer Education in Secondary and Elementary School Teacher Training," Proceedings of Rio Symposium on Computer Education for Developing Countries, June 12, 1972.

Barg, Benjamin, "International Cooperation and the Application of Computer Technology for Development," Proceedings of Rio Symposium on Computer Education for Developing Countries, June 12, 1972.

Bork, Alfred, "Computer Literacy for Teachers," from Seidel et al.: 91-98.

Brickman, William W., Tendencies in African Education, New York: The Free Press, 1972: 247-259.

Campbell, Donald T., "Reforms as Experiments," American Psychologist, April 1969: 409-429.

Carnoy, Martin, Education and Employment: A Critical Appraisal, Paris: International Institute for Educational Planning, 1978.

Carnoy, Martin, "Education for Alternative Development," Comparative Education Review, June 1982: 160-177.

Carron, Gabriel & Ta Ngoc Chau, Regional Disparities in Educational Development, Paris: International Institute for Educational Planning, 1980.

Center for Social Organization of Schools, "School Uses of Microcomputers," (Reports from a National Survey, Issue No. 2), The Johns Hopkins University, June 1983.

Chambers, Jack & Sprecher, Jerry, "Computer-Assisted Instruction: Current Trends and Critical Issues," Communications of the ACM, June 1980: 332-342.

Charp, S., Stolurow, L., & Jones, A., Models of Computer Aided Instruction for Columbia, India, and Yugoslavia, UNESCO, ED 75/WS/56, Paris, August 1975.

Charp, Sylvia, "Editorial," T.H.E. Journal, January, 1984: 11.

Chevion, Dov, "International Cooperation," Proceedings of Rio Symposium on Computer Education for Developing Countries, June 12, 1972: 9.03-9.05.

Collins, Ronald W., "Educational Computing: Past, Present and Future," Proceedings of National Educational Computing Conference (NECC), Norfolk, Va., June 25, 1980: 74.

Curle, Adam, "Educational Problems of Developing Societies - with Case Studies of Ghana, Pakistan and Nigeria," Praeger Publishers, New York, 1973.

deWet, J.J. & Calitz, L., "Educational Needs and Problems in Africa and the use of CAL," Computers in Education, Ed. Lewis & Tagg, WCCE/81, London: North Holland, 1981: 563-567.

Dreier, Oleg, "Problems Facing the Developing Countries: An Eastern European View," Prospects 12, 1982: 69-78.

Edstrom, Lars-Olaf, "Assistance to Correspondence Education in Africa," in Antoine Kabwasa and Martin Kaunda, eds., Correspondence Education in Africa, London: Routledge and Kegan Paul, 1973: 55-60.

Elliot, J., "Education in Africa, Crisis in Conflict," Development Southern Africa, 1975: 25-28.

Goodson, Bobby, & Lathrop, Ann, Microcomputer Courseware for the Classroom: Organizing and Using Instructional Software, Addison-Wesley, 1982.

Gumbert, Edgar B., Poverty, Power, and Authority in Education: Cross-cultural Perspectives, Atlanta: Center for Cross-Cultural Education, Georgia State University, 1981.

Guthrie, Gerard, "Reviews of Teacher Training and Teacher Performance in Developing Countries: Beeby Revisited(2)," International Review of Education 28, 1982: 291-306.

Harper, Dennis O., "Advantages and Disadvantages of Computer Education in Developing Countries," Proceedings of the Computer Using Educators, May, 1980.

Harper, Dennis O., Computer-Assisted Instruction, Module, Regents of the University of California, 1981.

Harper, Dennis O., "World Conference on Computers in Education," Comparative and International Education Society Newsletter, 63, 1982.

Harper, Dennis O. & Stewart, James, RUN: Computer Education, Monterey, CA, Brooks/Cole, 1983.

Harper, Dennis O., Using Computer Assisted Learning for Teacher Training in Malaysia, Ph.D. Dissertation, University of California, Santa Barbara, June, 1984.

Hunter, Beverly, "Computer Literacy: 1949-1979," from Seidel et al., 1982: 33-47.

Ignas, Edward & Corsini, Raymond J., Comparative Educational Systems, Itastca, Ill.:F.E. Peacock, Publishers, 1981.

Irizarry, Rafael L., "Overproduction and Unemployment in the Third World: The Paradoxes of Dependent Industrialization," Proceedings from Rio Symposium on Computer Education for Development, June 12, 1972: 338-352.

Lewis, Bob & Tagg, Donovan, Computer in Education, Participants Edition, North-Holland Publishing, 1981.

Maddux, Cleborne D., "The Educational Promise of Logo," Computers in the Schools, 1, Spring 1984: 79-89.

MECC, Introduction to Logo for Teachers, Minnesota Educational Computing Corporation, 1983.

Meyer, Luis Ferendo, "Computer Education in Elementary and Secondary Schools," Proceedings from the Rio Symposium on Computer Education for Development, June 12, 1972: 17-20.

Molnar, Andrew R., "The Next Great Crisis in American Education: Computer Literacy," AEDS Journal, 3, 1978: 11-20.

Mokweso, Mwenene, Papagiannis, George J., & Milton, Sande, "Education and Occupational Attainment from Generation to Generation: The Case of Zaire," Comparative Education Review, 28, 1984: 52-68.

Musgrove, Frank, Education and Anthropology: Other Cultures and the Teacher, Chichester: John Wiley & Sons, 1982.

Papert, S., Mindstorms, New York: Basic Books, 1980.

Postlethwaite, T. Neville & Thomas, R. Murray, Schooling in the ASEAN Region, Pergamon Press, 1980.

Roethlisberger, F.S. and Dickerson, W.J., Management and the Worker, Cambridge, MA: Harvard University Press, 1939.

Schneck, M., "Put Education into Computer Education," Communications of the ACM, 26, 1983: 145-150.

Seidel, Robert J., Anderson, Ronald E., & Hunter, Beverly, Computer Literacy: Issues and Directions for 1985, Academic Presss, 1982.

Swetz, Frank J., Langgulung, Hassan, & Abdul Rasid Johar, "Attitudes toward Mathematics and School Learning in Malaysia and Indonesia: Urban-Rural and Male-Female Dichotomies," Comparative Education Review, 27, 1983: 394-402.

Tomaasso, Carlo, "A Dynamic Approach to the Collection and Dissemination of Information," Computers in Education, IFIP, 1975, 2nd World Conference on Computer Education, Marseille: 937-945.

Thomas, R. Murray, & Surachmad Winarino, "Likes and Dislikes of Indonesian Pupils," Journal of Educational Research, 56, 1962: 68-74.

Thomas, R.M., "Back-Up Schemes for Educational Technology Breakdowns in Developing Nations," Aids to Programming, UNISEF Assistance to Education, Paris, UNESCO, #78, June, 1981.

Thomas, R. Murray, editor, Politics and Education, Pergamon Press, 1983.

Thornburg, David, Discovering Apple Logo, Reading, MA: Addison-Wesley, 1983.

Tillman, M.R., "An Examination of the Productive Validity of Several Potential Predictors of the Work Proficiency of Computer Programs," Computer, Personnel, 3, 1979: 3-6.

Todaro, Michael P., Economics for a Developing World, London: Longman, 1977.

Toffler, Alvin, The Third Wave, Bantam Books, 1980.

UNESCO, Statistical Yearbook 1977, UNESCO Paris, 1978.

UNESCO, Statistical Yearbook 1980, UNESCO Paris, 1980: 59.

Watt, Daniel, "Final Report of the Brookline Logo Project: Profiles of Individual Student Work," Logo Memo 54, MIT Logo Group, 1979.

Watt, Daniel, Learning with Logo, BYTE/McGraw-Hill, 1982.

Wood, A.W., Informal Education and Development in Africa, The Hague: Mouton, 1974.

World Bank, Education Sector Policy Paper, Washington D.C.: World Bank, 1980.

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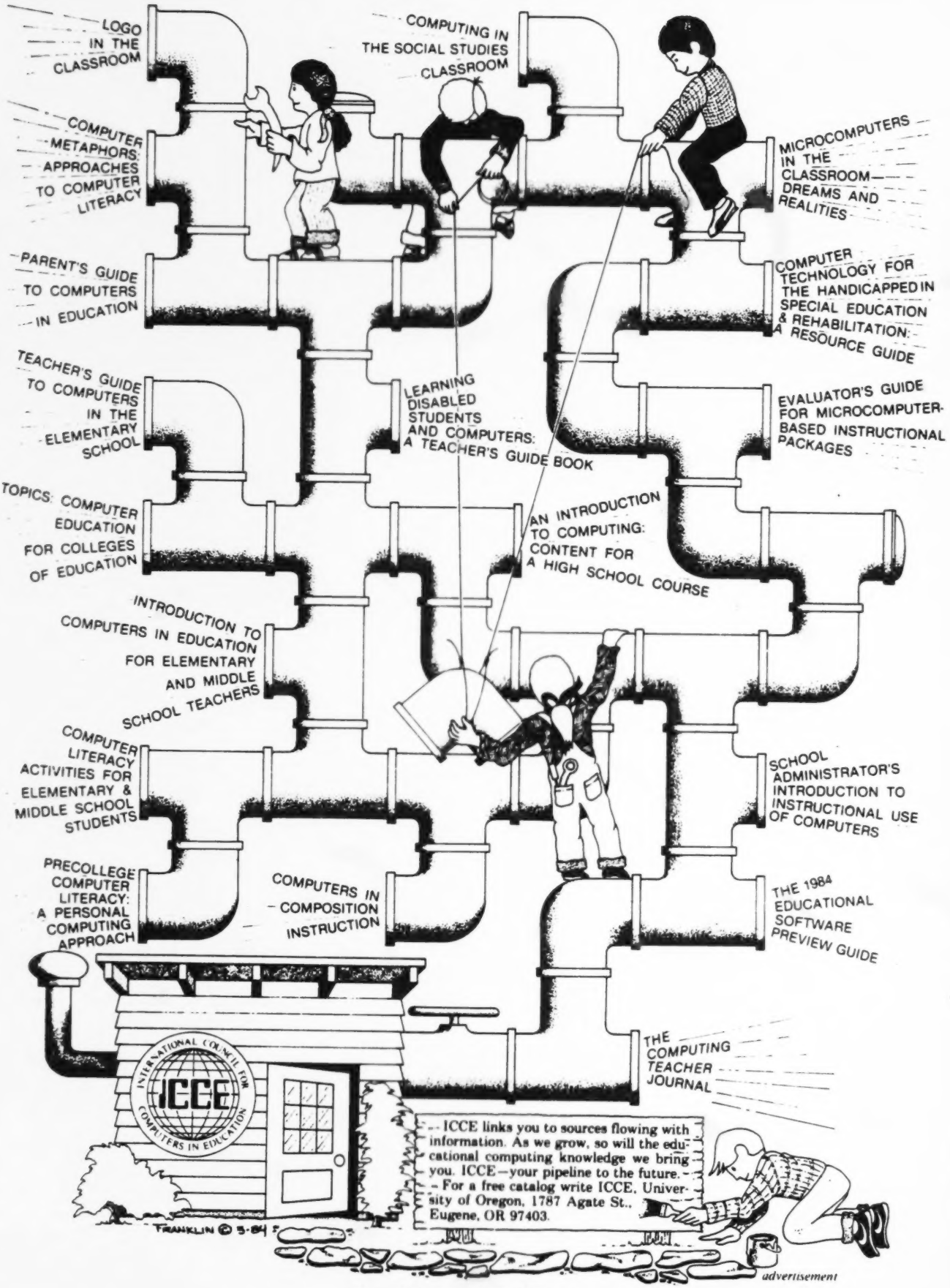
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